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Syllabus 2023-24
Panjab University

BSc

(CHEMISTRY)

THIRD SEMESTER

SCO 80-81, Sec.15D, Chandigarh

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CHEMISTRY**B.Sc. (GENERAL) SECOND YEAR EXAMINATION, 2023-2024****Scheme of Teaching and Examination****SEMESTER-III**

<i>Paper</i>	<i>Course</i>	<i>Teaching Hrs.</i>		<i>Max. Marks</i>
IX	Inorganic Chemistry-A	30	3 periods per week	22+3 internal assessment
X	Organic Chemistry-A	30	3 periods per week	22+3 internal assessment
XI	Physical Chemistry-A	30	3 periods per week	22+3 internal assessment
XII	Laboratory Practicals		6 periods per week	22+3 internal assessment
Total		15	periods/week	100

SEMESTER-IV

<i>Paper</i>	<i>Course</i>	<i>Teaching Hrs.</i>		<i>Max. Marks</i>
XIII	Inorganic Chemistry-B	30	3 periods per week	22+3 internal assessment
XIV	Organic Chemistry-B	30	3 periods per week	22+3 internal assessment
XV	Physical Chemistry-B	30	3 periods per week	22+3 internal assessment
XVI	Laboratory Practicals		6 periods per week	22+3 internal assessment
Total		15	periods/week	100

Total Marks**SEMESTER-III- 100****SEMESTER-IV- 100**

200

CHEMISTRY**SEMESTER-III**

<i>Paper</i>	<i>Course</i>	<i>Teaching Hrs.</i>		<i>Max. Marks</i>
IX	Inorganic Chemistry-A	30	3 periods per week	22+3 internal assessment
X	Organic Chemistry-A	30	3 periods per week	22+3 internal assessment
XI	Physical Chemistry-A	30	3 periods per week	22+3 internal assessment
XII	Laboratory Practicals		6 periods per week	22+3 internal assessment
Total		15 periods/week		100

Paper-IX: INORGANIC CHEMISTRY-A**Time : 3 Hrs****Max. Marks : 22+3****60 Hrs. (2 Hrs/Week)****3 Periods/Week****OBJECTIVE OF THE COURSE**

To teach the fundamental concepts of Chemistry and their applications. The syllabus pertaining to B.Sc. (GENERAL) (Semester system) in the subject of Chemistry has been upgraded as per provision of the UGC module and demand of the academic environment. The course contents have been revised from time to time as per suggestions of the teachers of the Chemistry working in the Panjab University, Chandigarh and affiliated colleges. The syllabus contents are duly arranged unit wise and contents are included in such a manner so that due importance is given to requisite intellectual and laboratory skills.

UNIT-I**(8 Hrs.)****Chemistry of Elements of First Transition Series:**Characteristic properties of *d*-block elements.

Properties of the elements of the first transition series, their simple compounds and complexes, illustrating relative stability of their oxidation states, coordination number and geometry.

UNIT-II**(7 Hrs.)****Chemistry of Elements of Second and Third Transition Series:**

General characteristics, comparative treatment with their *3d*-analogues in respect of ionic radii, oxidation states, magnetic behaviour, spectral properties and stereochemistry.

UNIT-III**(8 Hrs.)****Chemistry of Coordination Compounds-I**

Werner's coordination theory and its experimental verification, effective atomic number concept, chelates, nomenclature of coordination compounds, isomerism in coordination compounds

UNIT-IV**(7 Hrs.)****Chemistry of Coordination Compounds-II**

Valence bond theory of transition metal complexes. Properties of Coordination compounds i.e. magnetic properties, colours (Qualitative approach only), use of coordination compounds.

Instructions for paper setters and candidates:

- i. Examiner will set total of NINE questions comprising TWO questions from each unit and ONE compulsory question of short answer type covering whole syllabi.*
- ii. The students are required to attempt FIVE questions in all, ONE question from each unit and the Compulsory question.*
- iii. Compulsory question carries six marks and remaining all questions carry four marks each.*

Books Suggested

1. Cotton, F.A., Wilkinson, G., Gaus, P.L., Basic Inorganic Chemistry; 3rd edition, Pubs: John Wiley Sons. 1995.
2. Lee, J.D., Concise Inorganic Chemistry; 4th edition, Pubs: Chapman Hall Ltd., 1991.
3. Shriver, D.E., Alkins, P.W., Langford, C.H., Inorganic Chemistry; 4th edition, Oxford Publisher: Oxford University Press, 2006.
4. Douglas, B. McDamiel, D., Alexander, J., Concepts and Models of Inorganic Chemistry; 3rd edition, Pubs: John Wiley and Sons Inc., 1994.
5. Porterfield, W.W., Wesley, A., Inorganic Chemistry; Pubs: Addison-Wesley Publishing Company, 1984.
6. Miessler, G.L., Larr, D.A., Inorganic Chemistry; 3rd edition, Pubs: Pearson Education Inc., 2004.
7. Jolly, W.L., Modern Inorganic Chemistry; 2nd edition, Pubs: McGraw-Hill Publishing Company Limited, 1991.
8. Purcell, K.F., Kotz, J.C., Inorganic Chemistry; Pubs: W.B. Saunders Company, 1977.
9. Puri, B.R., Sharma, L.R., Kalia, K.C., Principles of Inorganic Chemistry; 30th edition, Pubs: Milestones Publisher, 2006-07.

Paper-X: ORGANIC CHEMISTRY-A

Time : 3 Hrs
Max. Marks : 22+3
60 Hrs. (2 Hrs/Week)
3 Periods/Week

OBJECTIVE OF THE COURSE

To teach the fundamental concepts of Chemistry and their applications. The syllabus pertaining to B.Sc. (GENERAL) (Semester system) in the subject of Chemistry has been upgraded as per provision of the UGC module and demand of the academic environment. The course contents have been revised from time to time as per suggestions of the teachers of the Chemistry working in the Panjab University, Chandigarh and affiliated colleges. The syllabus contents are duly arranged unit wise and contents are included in such a manner so that due importance is given to requisite intellectual and laboratory skills.

UNIT-I**(8 Hrs.)****Alcohols and Phenols:**

Classification and nomenclature

Monohydric alcohols-Nomenclature, methods of formation by reduction of aldehydes, ketones, carboxylic acids and esters. Hydrogen bonding. Acidic nature. Reactions of alcohols. Dihydric and Trihydric alcohols-Nomenclature, methods of formation, chemical reactions of vicinal glycols and glycerol.

Preparation of phenols, physical properties and acidic character. Comparative acidic strengths of alcohols and phenols, resonance stabilization of phenoxide ion. Reactions of phenols-electrophilic aromatic substitution, acylation and carboxylation. Mechanisms of Fries rearrangement, Claisen rearrangement, Gatterman synthesis, and Reimer-Tiemann reaction.

UNIT-II**(8 Hrs.)****Aldehydes and Ketones I**

Nomenclature and structure of the carbonyl group. Synthesis of aldehydes and ketones with particular reference to the synthesis of aldehydes from acid chlorides, synthesis of aldehydes and ketones using 1,3-dithianes, synthesis of ketones from nitriles and from carboxylic acids. Physical properties.

UNIT-III**(7 Hrs.)****Aldehydes and Ketones-II**

Mechanism of nucleophilic additions to carbonyl group with particular emphasis on benzoin, aldol, Perkin and Knoevenagel condensations. Condensation with ammonia and its derivatives. Wittig reaction, Mannich reaction.

Use of acetals as protecting group. Oxidation of aldehydes, Baeyer-Villiger oxidation of ketones, Cannizzaro reaction, MPV, Clemmensen, Wolff-Kishner, LiAlH_4 and NaBH_4 reductions.

UNIT-IV**Carboxylic Acids:****(7 Hrs.)**

Nomenclature, structure and bonding, physical properties, acidity of carboxylic acids, effects of substitutions on acid strength. Preparations of carboxylic acids. Reactions of carboxylic acids. Hell-Volhard-Zelinsky reaction. Synthesis of acid chlorides, esters and amides, Reduction of carboxylic acids. Mechanism of decarboxylation. Methods of formation and chemical reactions of halo acids. Hydroxyl acids: Malic, tartaric and citric acids (structural features only).

Methods of formation and chemical reactions of unsaturated monocarboxylic acids.

Dicarboxylic acids: Methods of formation and effects of heat and hydrating agents.

Instructions for paper setters and candidates:

- i. Examiner will set total of **NINE** questions comprising **TWO** questions from each unit and **ONE** compulsory question of short answer type covering whole syllabi.
- ii. The students are required to attempt **FIVE** questions in all, **ONE** question from each unit and the Compulsory question.
- iii. Compulsory question carries six marks and remaining all questions carry four marks each.

Books suggested

1. Morrison, R.T., Boyd, R.N., Organic Chemistry; 6th edition, Pubs: Prentice-Hall, 1992.
2. Wade Jr., L.G., Singh, M.S., Organic Chemistry; 6th edition, Pubs: Pearson Education, 2008.
3. Mukherji, S.M., Singh, S.P., Kapoor, R.P., Organic Chemistry; Pubs: Wiley Eastern Limited, 1985, Vol. I, II, III.
4. Solomons, T.W., Fryhle, C.B., Organic Chemistry; 9th edition, Pubs: Wiley India, 2007.
5. Carey, F.A., Organic Chemistry; 4th edition, Pubs: McGraw-Hill, 2000.
6. Streitwieser, A., Clayton, Jr., Heathcock, H., Introduction to Organic Chemistry; 3rd edition, Pubs: Macmillan Publishing Company, 1989.

Paper-XI: PHYSICAL CHEMISTRY-A

Time : 3 Hrs.
Max. Marks:22+3
60 Hrs. (2 Hrs./Week)
3 Periods/Week

OBJECTIVE OF THE COURSE

To teach the fundamental concepts of Chemistry and their applications. The syllabus pertaining to B.Sc. (GENERAL) (Semester system) in the subject of Chemistry has been upgraded as per provision of the UGC module and demand of the academic environment. The course contents have been revised from time to time as per suggestions of the teachers of the Chemistry working in the Panjab University, Chandigarh and affiliated colleges. The syllabus contents are duly arranged unit wise and contents are included in such a manner so that due importance is given to requisite intellectual and laboratory skills.

UNIT-I**(8 Hrs.)****Liquid State:**

Intermolecular forces, structure of liquids (a qualitative description).

Structural differences between solids, liquids and gases.

Liquid Crystals :Difference between liquid crystal, solid and liquid. Classification, structure of nematic and cholestric phases. Thermography and seven segment cell.

UNIT-II**(7 Hrs.)****Chemical Equilibrium:**

Equilibrium constant and free energy. Thermodynamic derivation of law of mass of mass action. Le - Chatelier's principle.

Reaction isotherm and Reaction isochore-Clapeyron equation and Clausius -Clapeyron equation, applications.

UNIT-III**(8 Hrs.)****Thermodynamics-II:**

Second Law of Thermodynamics: Need for the law, different statements of the law, Carnot cycle and its efficiency, Carnot theorem. Thermodynamic scale of temperature.

Concept of Entropy: Entropy as a state function, entropy as a function of V & T, entropy as a function of P & T, entropy change in physical change, Clausius inequality, entropy as a criteria of spontaneity and equilibrium. Entropy change in ideal gases and mixing of gases.

UNIT-IV**(7 Hrs.)****Thermodynamics-III:**

Third Law of Thermodynamics: Nernst heat theorem, statement and concept of residual entropy, evaluation of absolute entropy from heat capacity data. Gibbs and Helmholtz functions; Gibbs function (G) and Helmholtz functions (A) as thermodynamic quantities, A & G as criteria for thermodynamic equilibrium and spontaneity, their advantage over entropy change. Variation of G and A with P, V and T.

Instructions for paper setters and candidates:

- i. *Examiner will set total of NINE questions comprising TWO questions from each unit and ONE compulsory question of short answer type covering whole syllabi.*
- ii. *The students are required to attempt FIVE questions in all, ONE question from each unit and the Compulsory question.*
- iii. *Compulsory question carries six marks and remaining all questions carry four marks each.*

Books suggested

1. Atkins, P., Paula, J.de, Atkins Physical Chemistry; 8th edition, Pubs: Oxford University Press, 2008.
2. Puri, B.R., Sharma, L.R., Pathania, M.S., Principles of Physical Chemistry; 43rd edition, Pubs: Vishal Publishing Co., 2008.
3. Barrow, G.M., Physical Chemistry; 6th edition, Pubs: McGraw Hill Companies Inc, 1996.
4. Rao, C.N.R., University General Chemistry; Pubs: Macmillan of India, 1985.
5. Berry, R.S., Rice, S.A., Ross, J., Physical Chemistry; 2nd edition, Pubs: Oxford University Press, 2000.
6. Albert, R.A., Silbey, R.J., Physical Chemistry; 1st edition, Pubs: John Wiley & Sons Inc., 1992.
7. Dogra, S.K., Dogra, S., Physical Chemistry Through Problems, Pubs: Wiley Eastern Limited, 1991.
8. Levine, I.N., Physical Chemistry; 5th edition, Pubs: Tata McGraw Hill Publishing Co. Ltd, 2002.
9. Moore, W. J., Basic Physical Chemistry; Pubs: Prentice Hall of India Pvt. Ltd, 1983.
10. Metz, C.R., Theory and problems of Physical Chemistry; Schaum's outline series, 2nd edition, Pubs: McGraw-Hall Book Company, 1989.

Paper-XII: LABORATORY PRACTICALS**Max. Marks:22+3
6 Periods/week****Inorganic Chemistry**

Quantitative Analysis

Volumetric Analysis:

- Estimation of calcium content in chalk as calcium oxalate by permanganometry.
- Estimation of hardness of water by EDTA.
- Estimation of ferrous and ferric by dichromate method.
- Estimation of copper using sodium thiosulphate

Gravimetric Analysis

Analysis of Cu as CuSCN and Ni as Ni (dimethylglyoxime)₂.**Physical Chemistry**

Thermochemistry:

- To determine the solubility of benzoic acid at different temperatures and to determine ΔH of the dissolution process.
- To determine the enthalpy of neutralization of a weak acid/weak base versus strong base/strong acid and determine the enthalpy of ionization of the weak acid/weak base. pH of a Buffer solution, Determination of ionization constant of a weak acid.

General Instruction to the Examiners:

Note: Practical examination will be of four hours duration & shall consist of the following questions:

Q.No. I. Inorganic Chemistry	: 09 marks
Q.No. II. Physical Chemistry	: 06 marks
Q.No. III. Viva-Voce	: 04 marks
Ask four questions (2 marks each) related to chemistry practicals.	
Q.No. IV. Note Book	: 03 marks

Books Suggested (Laboratory Courses)

- Furniss, B.S., Hannaford, A.J., Rogers, V., Smith, P.W.G., Tatchell, A.R., Vogel's Text Book of Practical Organic Chemistry; 4th edition, Pubs: Longman group, 1978.
 - Bansal, R.K., Laboratory Manual of Organic Chemistry; 3rd edition, Pubs:Wiley Eastern Limited, New Delhi, 1994.
 - Furniss, B.S., Hannaford, A.J., Smith, P.W.G., Tatchell, A.R., Vogel's Textbook of Practical Organic Chemistry; 5th edition, Pubs: Dorling Kindersley (India) Pvt. Ltd. Delhi., 2006.
 - Khosla, B.D., Garg, V.C., Gulati, A., Senior Practical Physical Chemistry; 11th edition, Pubs: R. Chand & Co., New Delhi, 2002.
 - Das, R.C., Behra, B., Experimental Physical Chemistry; Pubs: Tata McGraw Hill Publishing Co. Ltd., 1983.
 - Levitt, B.P., Findlays Practical Physical Chemistry; 8th edition, Pubs: Longman Group Ltd., London & New York, 1978.
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